Animal-Fungal Interactions 1: Notes on Bowerbird's Use of Fungi

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Reports of ornithomycological interactions are scattered across multiple bird families, including: Acanthizidae, Alaudidae, Casuariidae, Corvidae, Dromaiidae, Glareolidae, Megapodiidae, Petroicidae, Prunellidae, Psittaculidae, Strigopidae, and Upupidae, (Simpson 1998; Simpson 2000; Beever & Lebel 2014). These records document fungi as food for birds ranging from Cassowaries to Siberian Jays; in some cases, fungi may comprise a seasonally significant portion of birds' diets (Andreev 1978; Alsheikh & Trappe 1983; Simpson 1998; Medway 2000; Doerr & Doerr 2002; Beever & Lebel 2014).

We here discuss the use of fungi for bower adornment. Bowerbirds are endemic to Australia and New Guinea, and the males of most species construct and decorate a bower to attract mates (Borgia 1986; Frith & Frith 2004; Hansell 2007). The materials and complexity of bowers vary between species and also between geographically disjunct populations of the same species (Diamond 1986; Madden *et al.* 2004). The bowers are made from leaves, sticks, vines, grasses, and other suitable materials (Hansell 2007). Some species paint the bower walls with charcoal or their colourful saliva, whereas others decorate with leaves, pieces of plastic, glass, sun-bleached bones, mushrooms, berries, flowers, or various other brightly coloured objects (Chisholm 1924; Gannon 1930; Diamond 1986; Hansell 2007).

Colour preference among Bowerbirds is generally species dependent, while intraspecific variation may occur according to population, age, and bower building experience (Madden 2001). The primary colour selected by the Satin Bowerbird, *Ptilonorhynchus violaceus,* for bower adornment is generally some shade of blue; however, certain favoured objects will stray from this colour motif (Edwards 1920; Nubling 1921; Borgia 1985; Wojcieszek *et al.* 2006; Hansell 2007). Use of fungi for decoration has been reported for different Bowerbird species, but most of these reports are inconclusive with regard to fungal identity. The fleshy fungi of Australasia are diverse; many are brightly coloured, providing potential for bower ornaments (Fuhrer 2005).

In 1931 at a site approximately 100 km south of Sydney, A.J. Marshall reported '*Geaster saccatus*' in the bower of a *Ptilonorhynchus violaceus* (Marshall 1932). This name is likely an orthographic variant for the Earthstar Mushroom, Geastrum saccatum; however, we do not believe there is a voucher specimen to verify Marhsall's identification. (Species Fungorum 2015). We found other reports dating back to the 1800s of fungi, black bracket fungi, mushrooms, and puffballs being used by *Amblyornis inornata* (Vogelkop Bowerbirds), *Chlamydera maculata* (Spotted Bowerbird), and *Ptilonorhynchus violaceus* (Satin Bowerbird), but unfortunately these reports are too taxonomically vague to determine what taxa of fungi were involved (Beccari 1878; Nubling 1921; Marshall 1934, Diamond 1986; Diamond 1988; Uy & Borgia 2000; Madden 2003).

Results and discussion

In August 2010 while working near Braidwood, in south-east New South Wales, we encountered several upturned and torn *Lepista nuda* mushrooms with obvious beak marks piled beside a blue plastic livestock ear tag. This unusual assemblage of objects was discovered under the low hanging branches of a European plum, *Prunus domestica*. Further investigation of the area, anecdotal reports from past years, the pale violet to pale lilac coloured fungi, and the blue ear tag led us to believe that this was the early stages of a *Ptilonorhynchus violaceus* bower.

This rudimentary bower was likely the work of a young male still establishing his territory, as it sometimes takes Bowerbirds several years before they become proficient enough at bower construction to attract a mate (Marshall 1932; Borgia 1985; Borgia 1986). Repeated observation

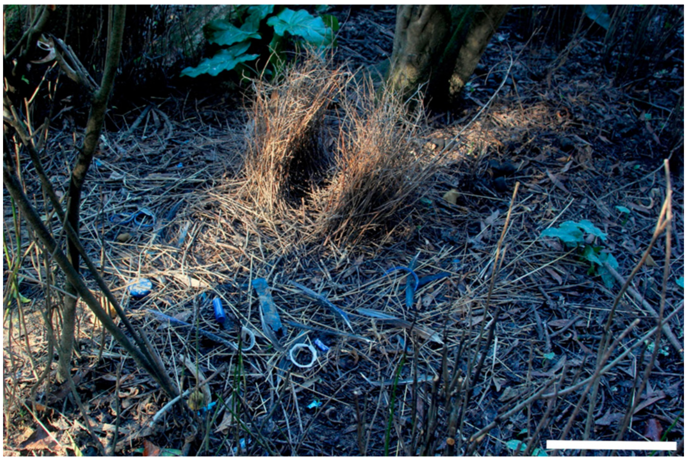

Figure 1. The same bower location in 2015 with well established bower and collection of ornaments. At this visit the bower ornaments primarily consisted of marker caps, bottle rings, and *Platycercus elegans* (Crimson Rosella) tail feathers. Scale bar 30 cm.

of this area over the next five years revealed continued *Ptilonorhynchus violaceus* activity (Figure 1). *Lepista nuda* has become established and now fruits regularly throughout this same location.

Lepista nuda is edible and sometimes cultivated for human consumption. It is believed to have been introduced to Australia with planting stock imported for ornamental or forestry purposes (Furhrer 2005). DNA analysis is needed, but we speculate that this population of *Lepista nuda* may have been introduced into the Braidwood area in the early 1860s. We have observed *Lepista nuda* fruiting under a large introduced Cork Oak, *Quercus suber*, at The Braidwood Courthouse approximately 14 km away from the bower location. This tree was planted around the time the courthouse was built in 1861. Considering the nursery practices of the nineteenth century and the limited viability of Cork Oak seeds following long-term storage and transport, this tree was likely obtained as a seedling from a foreign nursery. Thus, *Lepista nuda* spores or hyphae could have been transported in the soil.

Conclusion

Given the fondness of *Ptilonorhynchus violaceus*' for blue colours like the pale violet to pale lilac of *Lepista nuda* (Figure 2), it is expected that they will continue to collect this species for bowers and so assist with the dispersal of *Lepista nuda* —and other blue fungi—throughout the Bowerbird's range. In this note we have a sample size of one; however, in the review portion we show that Bowerbird use of fungi is not a novel occurrence but simply poorly documented and understudied. We believe further research will show that it occurs among many bowerbird species. We urge Bowerbird researchers to take meticulous notes and/or collect voucher specimens of fungi found in bowers; that way, ornithologists and mycologists can collaborate to better understand the potential ecological importance of these interesting ornithomycological interactions.

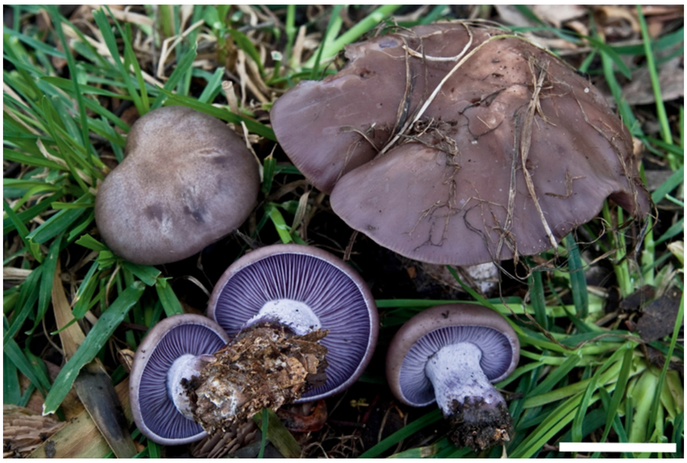

Figure 2: A collection of Blewits Lepista nuda, a non-native species in Australia possibly dispersed by Satin Bowerbirds, Ptilonorhynchus violaceus. Scale bar 5 cm.

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References

Alsheikh, A.M. & Trappe, J.M. 1983. Taxonomy of *Phaeangium lefebvrei,* a desert truffle eaten by birds. *Canadian Journal of Botany* **61**: 1919-1925. http://dx.doi.org/10.1139/b83-204

Andreev, A.V. 1978. Winter energy balance and hypothermia of the Siberian Jay. *Sov. J. Ecol.* **9**: 352-357.

Beccari, O. 1878. The gardener bird and a new orchid. *The Gardeners' Chronicle* 16: 332-333.

Beever, R.E. & Lebel, T. 2014. Truffles of New Zealand: a discussion of bird dispersal characteristics of fruit bodies. *Auckland Botanical Society Journal* **69**: 170-178.

Borgia, G. 1985. Bower destruction and sexual competition in the satin bowerbird (*Ptilonorhynchus violaceus*). *Behaviorial Ecology and Sociobiology* **18**: 91-100.

Borgia, G. 1986. Sexual selection in bowerbirds. *Scientific American* **254**: 92-101. http://dx.doi.org/10.1038/scientificamerican0686-92

Chisholm, A.H. 1924. Is there any reasonable limit to the ability or the intelligence of Australia's bower-birds?. *Emu* **24**: 150. http://dx.doi.org/10.1071/MU924149b

Diamond, J. 1986. Animal art: Variation in bower decorating style among male bowerbirds *Amblyornis inoratus*. *Proceedings of the National Academy of Science* **83**: 3042-3046. http://dx.doi.org/10.1073/pnas.83.9.3042

Diamond, J. 1988. Experimental study of bower decoration by the bowerbird *Amblyornis inornatus*, using coloured poker chips. *American Naturalist* **131**: 631-635. http://dx.doi.org/10.1086/284811

Doerr, E.D. & Doerr, V.A.J. 2002. Utilization of nectar and other non-insect food resources by treecreepers. *Corella* **26**: 22-23.

Edwards, H.V. 1920. Colour-sense in bower-birds. *Emu* **39**: 273.

Frith, C.B. & Frith, D.W. 2004. *The Bowerbirds: Ptilonorhynchidae*. Oxford University Press, Oxford.

Fuhrer, B.A. 2005. *A field guide to Australian fungi*. Melbourne: Bloomings Books.

Gannon, R.A. 1930. Observation on the satin bower bird with regard to the material used by it in painting its bower. *Emu* **30**: 39-41. http://dx.doi.org/10.1071/MU930039

Hansell, M. 2007. *Built by Animals: The Natural History of Animal Architecture*. Oxford University Press Inc., New York, NY.

Hill, R. 1967. *Australian Birds*. Funk & Wagnalls, New York, NY.

Madden, J.R. 2001. Sex, bowers and brains. *Proceedings of the Royal Society of London* **268**: 833-838. http://dx.doi.org/10.1098/rspb.2000.1425

Madden, J.R. 2003. Bower decorations are good predictors of mating success in the spotted bowerbird. *Behavioral Ecology and Sociobiology* **53**: 269–277.

Madden, J.R., Lowe, T.J., Fuller, H.V., Dasmathapatra, K.K. & Coe, R.L. 2004. Local traditions of bower decoration by spotted bowerbirds in a single population. *Animal Behaviour* **68**: 759–765.

Marshall, A.J. 1932. Notes on the Satin Bower-bird. *Emu* **32**: 33-38. http://dx.doi.org/10.1071/MU932033

Marshall, A.J. 1934. Notes on the Satin Bower-bird in South-eastern Queensland. *Emu* **34**: 57-61. http://dx.doi.org/10.1071/MU934057

Medway, D.G. 2000. Mycophagy by North Island robin. *Australasian Mycologist* **19**: 102.

Nubling, E. 1921. The satin bower bird—some observations. *Emu* **21**: 11-31. http://dx.doi.org/10.1071/MU921011

Simpson, J.A. 1998. Why don't more birds eat more fungi?. *Australasian Mycological Newsletter* **17**: 67-68.

Simpson, J.A. 2000. More on mycophagous birds. *Australasian Mycologist* **19**: 49-51.

Species Fungorum. 2015. Fungal taxonomy available online: http://www.speciesfungorum.org/Names/SynSpecies.asp?RecordID=536304 (retrieved 7 December 2015).

Uy, J.A.C. & Borgia, G. 2000. Sexual selection drives rapid divergence in bowerbird display traits. *Evolution* **54**: 273-278. http://dx.doi.org/10.1111/j.0014-3820.2000.tb00027.x

Wojcieszek, J.M., Nicholls, J.A., Marshall, N.J., & Goldizen, A.W. 2006. Theft of bower decorations among male satin bowerbirds (*Ptilonorhynchus violaceus*): Why are some decorations more popular than others?. *Emu* **106**: 175-180. http://dx.doi.org/10.1071/MU05047